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Vacuum Products Division



SH-112 Dry Scroll Vacuum Pump

INSTRUCTION MANUAL

MANUALE DI ISTRUZIONI

NOTICE DE MODE D'EMPLOI

BEDIENUNGSHANDBUCH

使用手册

使用説明書

사용 설명서



Manual No. 699904430

Revision C

June 2014

SH-112 Dry Scroll Vacuum Pump



Warranty

Products manufactured by Seller are warranted against defects in materials and workmanship for twelve (12) months from date of shipment thereof to Customer, and Seller's liability under valid warranty claims is limited, at the option of Seller, to repair, to replace, or refund of an equitable portion of the purchase price of the Product. Items expendable in normal use are not covered by this warranty. All warranty replacement or repair of parts shall be limited to equipment malfunctions which, in the sole opinion of Seller, are due or traceable to defects in original materials or workmanship. All obligations of Seller under this warranty shall cease in the event of abuse, accident, alteration, misuse, or neglect of the equipment. In-warranty repaired or replaced parts are warranted only for the remaining unexpired portion of the original warranty period applicable to the repaired or replaced parts. After expiration of the applicable warranty period, Customer shall be charged at the then current prices for parts, labor, and transportation.

Reasonable care must be used to avoid hazards. Seller expressly disclaims responsibility for loss or damage caused by use of its Products other than in accordance with proper operating procedures.

Except as stated herein, Seller makes no warranty, expressed or implied (either in fact or by operation of law), statutory or otherwise; and, except as stated herein, Seller shall have no liability under any warranty, expressed or implied (either in fact or by operation of law), statutory or otherwise. Statements made by any person, including representatives of Seller, which are inconsistent or in conflict with the terms of this warranty shall not be binding upon Seller unless reduced to writing and approved by an officer of Seller.

Warranty Replacement and Adjustment

All claims under warranty must be made promptly after occurrence of circumstances giving rise thereto, and must be received within the applicable warranty period by Seller or its authorized representative. Such claims should include the Product serial number, the date of shipment, and a full description of the circumstances giving rise to the claim. Before any Products are returned for repair and/or adjustment, written authorization from Seller or its authorized representative for the return and instructions as to how and where these Products should be returned must be obtained. Any Product returned to Seller for examination shall be prepaid via the means of transportation indicated as acceptable by Seller. Seller reserves the right to reject any warranty claim not promptly reported and any warranty claim on any item that has been altered or has been returned by non-acceptable means of transportation. When any Product is returned for examination and inspection, or for any other reason, Customer shall be responsible for all damage resulting from improper packing or handling, and for loss in transit, notwithstanding any defect or non-conformity in the Product. In all cases, Seller has the sole responsibility for determining the cause and nature of failure, and Seller's determination with regard thereto shall be final.

If it is found that Seller's Product has been returned without cause and is still serviceable, Customer will be notified and the Product returned at the Customer's expense; in addition, a charge for testing and examination may be made on Products so returned.

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Instructions for Use

General Information

This equipment is designed for use by professionals. The user should read this instruction manual and any other additional information supplied by Agilent before operating the equipment. Agilent will not be held responsible for any events that occur due to non-compliance with these instructions, improper use by untrained persons, non-authorized interference with the equipment, or any action contrary to that provided for by specific national standards.

The SH-112 is a hermetic, dry scroll vacuum pump. This pump is suitable for pumping air or inert gases. The pump is not intended to pump corrosive, explosive, or particulate-forming gases.

The following paragraphs contain all the information necessary to guarantee the safety of the operator when using the equipment. Detailed information is supplied in "Technical Information" on page 15.

This manual uses the following standard safety protocol:

WARNING



The warning messages are for attracting the attention of the operator to a particular procedure or practice which, if not followed correctly, could lead to serious injury.

CAUTION



The caution messages are displayed before procedures, which if not followed, could cause damage to the equipment.

NOTE



The notes contain important information taken from the text.

Storage

When transporting and storing the pump, the following environmental requirements should not be exceeded:

Temperature: $-20\text{ }^{\circ}\text{C}$ to $+60\text{ }^{\circ}\text{C}$ ($-4\text{ }^{\circ}\text{F}$ to $140\text{ }^{\circ}\text{F}$)

Relative humidity: 0 to 95% (non-condensing)

Preparation for Installation

The pump is supplied in a special protective packing. If this shows signs of damage, which may have occurred during transport, contact your local sales office.

Total weight of the packing, SH-112 pump included, is approximately 20 kg (44 lbs).

WARNING



When unpacking the pump, be sure not to drop it and avoid any kind of sudden impact or shock vibration to it.

NOTE



Normal exposure to the environment cannot damage the pump. Nevertheless, it is advisable to keep the pump inlet closed until the pump is installed in the system.

Installation

Do not install or use the pump in an environment exposed to atmospheric agents (rain, snow, ice), dust, aggressive gases, or in explosive environments or those with a high fire risk.

If placing the SH-112 pump inside an enclosure, provide ample room to supply ambient air to both the front and rear air intakes of the pump.

During operation, the following environmental conditions must be respected:

Temperature: +5 °C to +40 °C (41 °F to 104 °F)

Relative humidity: 0 to 95% (non-condensing)

CAUTION



Be certain that your electrical mains power voltage corresponds to that indicated on the white tab (110 or 220) adjacent to the On/Off switch on the rear of the pump.

If voltage changeover is required, use a small screwdriver to remove the tab holder from the power module. Position the white tab so that the correct voltage faces out and reinstall the tab holder.

Connect the pump to the power supply using an IEC-320 style power cord of at least 10 A capacity.

Use

In order to reach maximum vacuum, the pump must be left running for about an hour with the inlet sealed.

There are no special instructions for starting the pump; it need only be switched on using the On/Off switch.

The inlet valve will open 10 seconds after the pump is started.

WARNING



The pump is designed for operation with neutral or noncorrosive fluids. It is absolutely forbidden to use it with potentially explosive or inflammable substances.

There are no special instructions for stopping the pump; it need only be disconnected from the electric power source by the On/Off switch.

The inlet valve will close immediately after the pump is stopped.

Maintenance

Personnel responsible for pump operation and maintenance must be well-trained and aware of the accident prevention rules.

WARNING



❑ *Death may result from contact with high voltages. Always take extreme care and observe the accident prevention regulations in force.*

❑ *When machine is powered up, be careful of moving parts and high voltages.*

❑ *If you have to perform maintenance on the pump after a considerable time in operation, allow it to cool as the temperature of the outer surface may be in excess of 60 °C.*

❑ *Always disconnect your power supply to the pump before beginning maintenance work.*

NOTE



Before returning the pump to the factory for repair, the "Health and Safety" sheet attached to this instruction manual must be completed and sent to the local sales office. A copy of the sheet must be inserted in the pump package before shipping.

If a pump is to be discarded, it must be disposed of in accordance with specific national standards.

Technical Information

Table 1 Specifications

Model	SH-112 Dry Scroll Single Hermetic Vacuum Pump
Interface dimensions	See Figure 1 on page 16
Peak pumping speed	50 Hz: 90 L/m, 5.4 m ³ /hr (3.3 cfm) 60 Hz: 110 L/m, 6.6 m ³ /hr (4.0 cfm) See Figure 2 on page 16 for details
Media	No corrosive, explosive or particulate forming gases
Ultimate pressure	2.0×10^{-1} Torr (2.6×10^{-1} mbar)
Maximum inlet pressure	1.0 atmosphere (0 psig)
Maximum outlet pressure	1.5 atmosphere (7.5 psig)
Inlet connection	NW25
Exhaust connection	Female 1/4" NPT (NW16 adapter provided)
Gas ballast	Female 1/8" NPT, (20 micron sintered plug provided; shipped with solid plug)
Ambient operating temperature	5 °C to 40 °C (41 °F to 104 °F)
Storage temperature	-20 °C to 60 °C (-4 °F to 140 °F)
Motor rating	0.25 HP (0.19 kW)
Operating voltages	1 phase/50-60 Hz/100-115:200-230 VAC \pm 10%
Run current	See Table 3 on page 20
Motor thermal protection	Automatic thermal protection
Operating speed	60 Hz: 1725 RPM, 50 Hz: 1425 RPM
Cooling system	Air-cooled
Weight	Pump only: 19.5 kg (43 lbs) Shipping weight: 20 kg (44 lbs)
Leak rate (with exhaust sealed)	$<1 \times 10^{-7}$ atm-cc/sec helium
Noise Level (per ISO 11201)	56 dB(A)
Vibration level at inlet (per ISO 10816-1)	Class 1B, 1.5 mm/s
Fuse type	M5 x 20 mm, 10 A, Slo-Blo, Littelfuse Model H215010 or equivalent
Hour meter	Integral Hour Meter provided, displays running time to closest .1 hour
Conformance standards	Conforms to SEMI S2-2000 and applicable CSA, CUS, and CE standards.
Installation	Indoor use, Installation Category II, Pollution Degree 2
Altitude	2000 m (6562')

SH-112 Dry Scroll Vacuum Pump

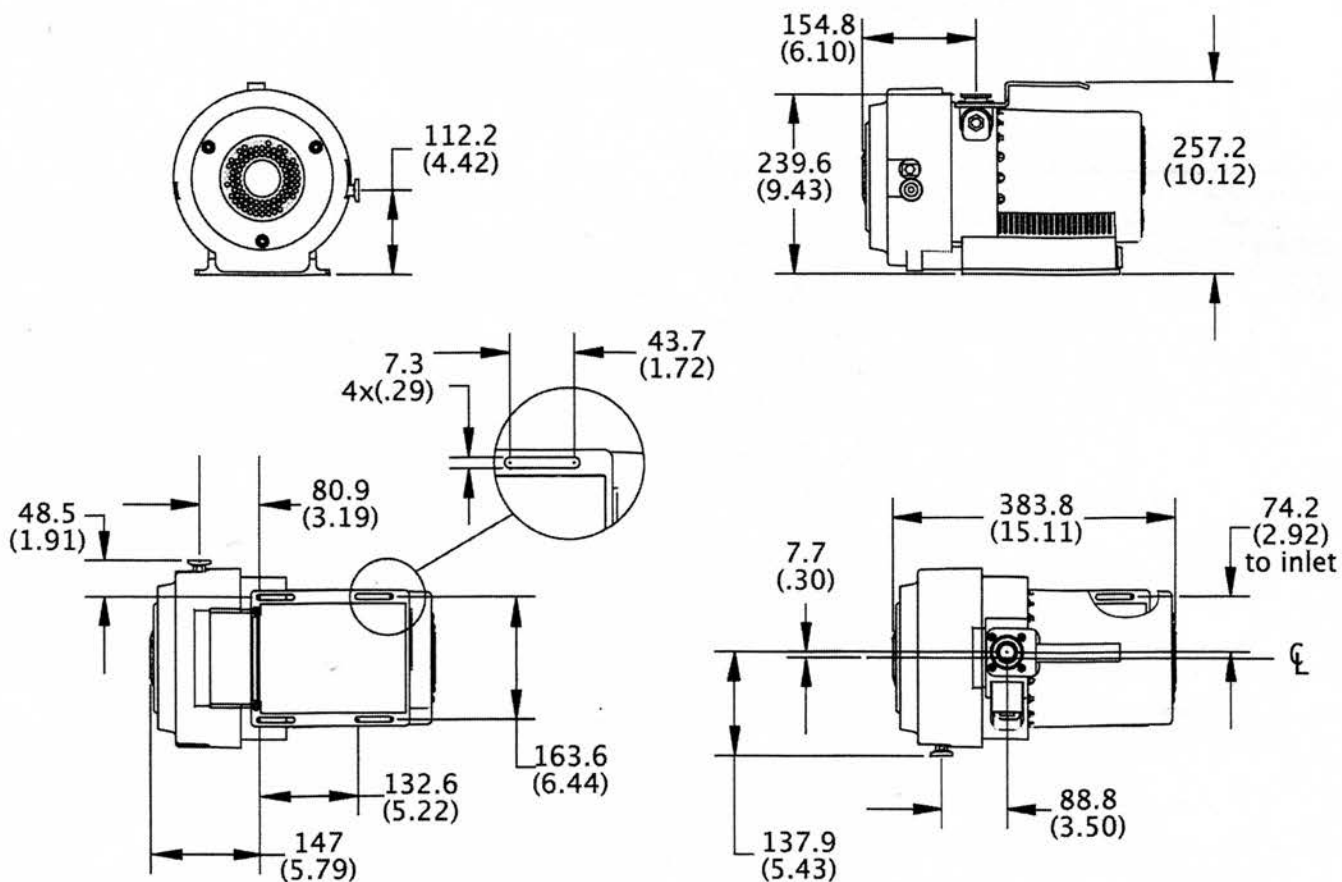


Figure 1 Interface Drawing with Dimensions

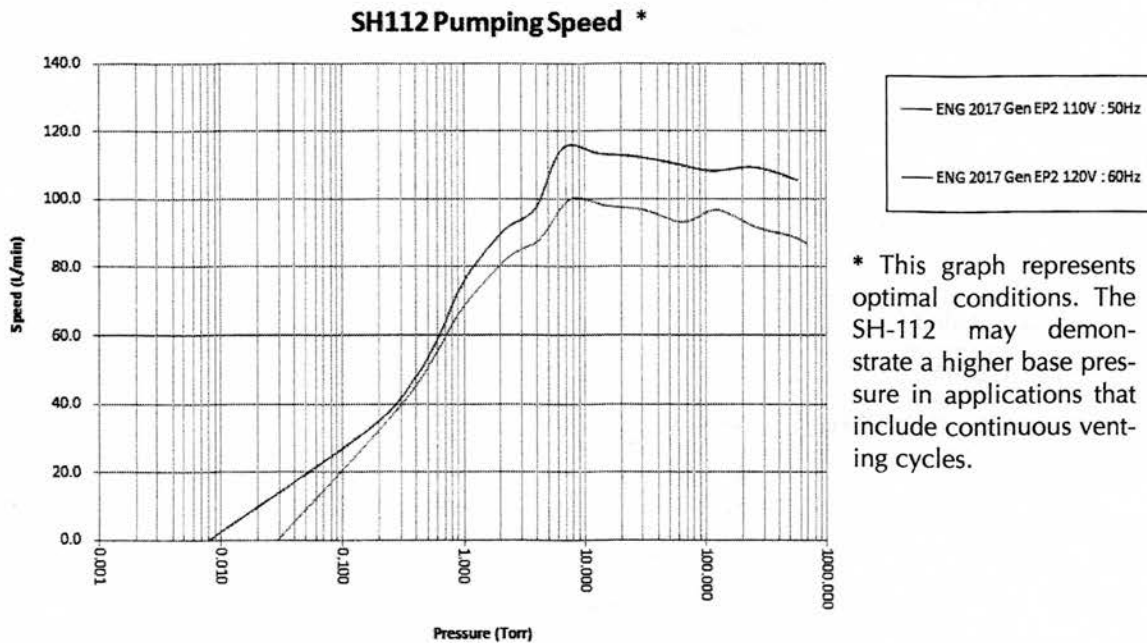
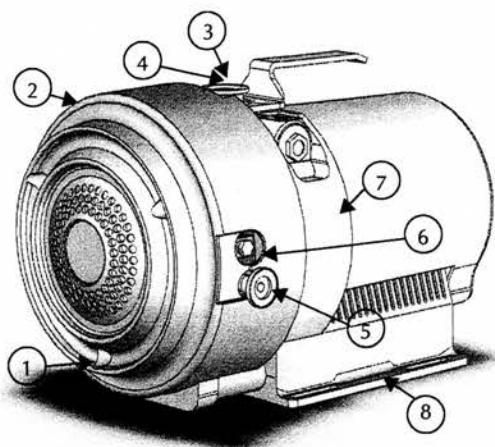


Figure 2 Pumping Speed Curves

SH-112 Dry Scroll Vacuum Pump



1. Front Cowling Screws; M8 (3)
2. Front Cowling
3. Inlet (NW25)
4. Inlet Screen
5. Exhaust Adapter NW16
6. Gas Ballast Port (1/8" National Pipe Thread)
7. Frame
8. Base
9. Mounting Slots; (4) for 1/4" or M6 Hardware
10. Rear Cowling
11. Rear Cowling Screws: M5 (3)
12. On/Off Switch
13. Fuse Holder and Voltage Changeover Tab
14. Power Connection (IEC-320)
15. Hour Meter

Unpacking and Inspection

1. Orient the shipping container with "This End Up" on top.
2. Open the box and carefully lift the SH-112 out of the box.
3. Save the carton and all packing materials.
4. Inspect the pump for damage. If there is shipping damage, contact the freight carrier and your local Agilent sales office immediately.

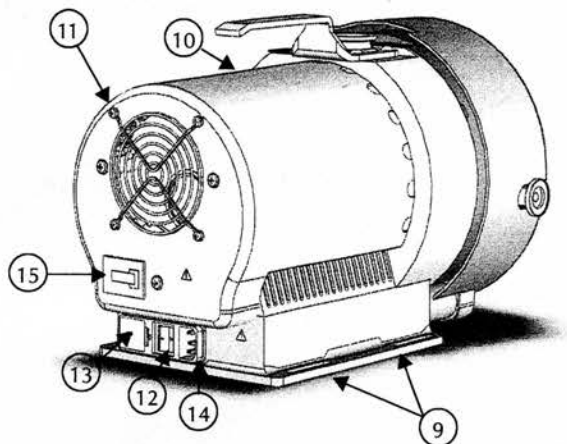


Figure 3 Outline Drawing and Principal Items

Installation

Safety

Do not remove or modify any safety or insulating equipment from the pump. To do so may create a serious safety hazard and may void the warranty.

WARNING



❑ *This pump is capable of pumping and exhausting air and inert gases only. It is not designed to pump explosive, flammable, corrosive or particulate forming gases. They can cause bodily injury, explosion, or fire.*

❑ *Install in an area that is not exposed to rain, steam, or excessive humidity. They can cause electric shock, short circuits, and severe bodily injury.*

❑ *Before reconfiguring the pump voltage, or inspecting or servicing the pump, be sure the electrical supply is disconnected.*

❑ *The gas ballast must be sealed whenever pumping any gas not intended to be vented to the atmosphere.*

❑ *An exhaust silencer option is available for those applications in which it is desirable to diminish the sound level produced by the pump.*

❑ *To prevent bodily injury, avoid exposing any part of the human body to vacuum.*

CAUTION



Although the pump can pump trace particulates normally found in the atmosphere, it is not designed to process solids, chemicals, powders, solvents, condensates, or other particulates. They can damage the equipment, degrade its performance, or shorten its useful life.

Startup

1. Check that the inlet screen is installed before beginning operation.

WARNING



Do not insert a finger or any foreign object in the path of the fan; serious personal injury may result or the pump may be damaged.

2. Operate the pump at an ambient temperature of 5 °C to 40 °C (41 °F to 104 °F), otherwise damage to the pump or shortened operating life may result.

CAUTION



Do not block the fan ducts. Blocking these ducts can cause pump overheating. A pump surface temperature in excess of 65 °C (150 °F) is potentially damaging. If such conditions are observed, turn the pump off and allow it to cool. Disassemble, inspect for damage, and repair, if necessary.

Electrical Connections

The pump can be configured for low voltage, 100 VAC to 115 VAC, or for high voltage, 200 VAC to 230 VAC.

The pump as delivered from the factory is configured for low voltage. To change the pump voltage follow this procedure:

WARNING



Risk of electric shock. Disconnect the pump from electrical power mains before attempting to change the voltage configuration.

1. Verify your electrical supply voltage.
2. Use a small flat blade screwdriver to release the fuse holder from the power entry module.
3. Carefully pop out the white plastic assembly and reinsert with the desired operating voltage showing outward.
4. Reinsert the fuse holder into the power entry module.

SH-112 Dry Scroll Vacuum Pump

Power Cord

Several power cord options are available from your Agilent dealer. Descriptions of the available power cords and their ordering numbers are given in Table 2.

NOTE



For high voltage operation, the pump must be connected to the power supply using a high voltage IEC-320 type power cord of at least 10 A capacity.

Table 2 SH-112 Power Cord Selection

Country	Power Cord Specification	Order
Europe	10 A / 220-230 VAC, 2.5 m	656494220
Denmark	10 A / 220-230 VAC, 2.5 m	656494225
Switzerland	10 A / 230 VAC, 2.5 m	656494235
UK/Ireland	13 A / 230 VAC, 2.5 m	656494250
India	10 A / 220-250 VAC, 2.5 m	656494245
Israel	10 A / 230 VAC, 2.5 m	656494230
Japan	12 A / 100 VAC, 2.3 m	656494240
North America	15 A / 125 VAC, 2.0 m	656458203
	10 A / 230 VAC, 2.5 m	656494255

Grounding Instructions

This product should be grounded. In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current. This pump is equipped with a power cord that has a grounding wire with an appropriate grounding plug. The plug must be inserted into an outlet that is properly installed and grounded in accordance with all local codes and ordinances.

DANGER



Improper installation of the grounding plug can result in a risk of electrical shock.

For United States and Canadian installations:

- When this product is configured for use on a nominal 120 V circuit, it must be used with a grounding plug that looks like the plug illustrated in Figure 4.
- If repair or replacement of the cord or plug is necessary, connect the grounding wire to the grounding terminal only.
- The grounding wire is insulated and its outer surface is either solid green or solid green with a yellow stripe.
- When this product is configured for use on a nominal 220 V circuit, it must be used with a factory supplied cord and plug that permits connection to the proper electric circuit. See "Electrical Connections" on page 18 for proper rating and type of cord set.

WARNING



Check with a qualified electrician or serviceman if the grounding instructions are not completely understood, or if you are in doubt as to whether the product is properly grounded.

Do not modify the plug provided; if it does not fit the outlet, have the proper outlet installed by a qualified electrician.

Connect the product only to an outlet that has the same configuration as the plug.

Do not use an adapter with this product.

SH-112 Dry Scroll Vacuum Pump

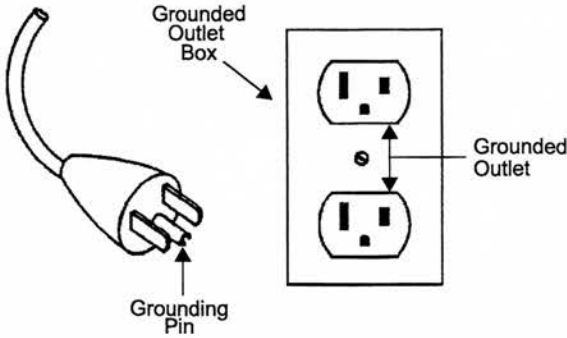


Figure 4 Grounding Plug and Outlet

Extension Cords

If you must use an extension cord with this product:

- For this product, Agilent recommends using only extension cords with a minimum of 16-gage wire and a maximum length of 25 feet (7.6 m).
- Use only a 3-wire extension cord that will accept the plug.
- Make sure your extension cord is in good condition.
- Be sure the extension cord is rated high enough to carry the current your product will draw. An under-sized cord will cause a drop in line voltage resulting in loss of power and overheating.

WARNING



If the product must be reconnected for use on a different type of electric circuit, the connector should be replaced by qualified service personnel.

Run Currents

Typical run currents listed in Table 3 are approximately constant from minimum to maximum intake pressure.

Table 3 SH-112 Typical Run Currents

Frequency	Low Voltage Range				High Voltage Range			
	90 V	100 V	115 V	126 V	180 V	200 V	230 V	252 V
60 Hz	4.4	4.2	4.0	3.7	2.2	2.1	2.0	1.9
50 Hz	4.1	4.1	4.2	4.2	2.1	2.1	2.1	2.1

Start Current

Table 4 lists the typical SH-112 maximum starting current and duration.

Table 4 Typical SH-112 Maximum Starting Current and Duration @ 115 V

50 Hz		60 Hz	
Current (A)	Time (ms)	Current (A)	Time (ms)
24	250	26	250

Mechanical Connections

Isolation Valve

The SH-112 has an integral automatic isolation valve. An internal timer opens the valve 10 seconds after the pump is switched ON. If power is lost or the pump is switched OFF, the isolation valve will immediately close.

Pump Inlet

Use NW25, or larger, clean vacuum hardware with as short a length as practical between the pump and vacuum chamber.

Insert a bellows between the pump and vacuum chamber to provide both vibration isolation and strain relief.

Pump Exhaust

A female 1/4" National Pipe Thread exhaust fitting is located radially near the front of the pump. Additionally, an NW16 male adapter with 1/4" National Pipe Thread is provided. To avoid overheating the pump, do not restrict the exhaust flow with long lengths of small diameter tubing. Use as short as practical lengths of NW16, or larger, diameter hardware.

Gas Ballast

The pump incorporates an automatic gas ballast to prevent water and other condensates from accumulating within the pump. The standard configuration has a solid plug installed in the 1/8" National Pipe Thread gas ballast port (item 6 on Figure 3 on page 17). This configuration can be used for relatively dry applications. A sintered filter plug is also supplied with the pump. The filter plug can be installed in the gas ballast port and will allow enough atmospheric air to enter the pump to purge condensates while not affecting pump ultimate pressure or pumping speed.

For applications where the ingress of atmospheric air is undesirable, dry nitrogen at a flow rate of approximately 2 L/m can be bled into the gas ballast port.

WARNING



The gas ballast must be sealed whenever pumping any gas not intended to be vented to atmosphere.

Operation

Cleaning the Pump

Unlike conventional oil-sealed pumps, Agilent dry scroll pumps do not contain fluid for the cleansing of accumulated dust and debris. Run the pump periodically at atmosphere for a minute or two to flush it out. Until experience is gained on your specific process, flush the pump regularly and adjust this schedule according to your specific conditions.

Startup Procedure

1. Make sure that the pump is configured for the mains voltage to which the pump is connected.

NOTE



The pump ON/OFF switch is a rocker type switch that has symbols in accordance with IEC Publication 417 to represent the ON and OFF positions. Figure 5 shows a switch in the ON position.

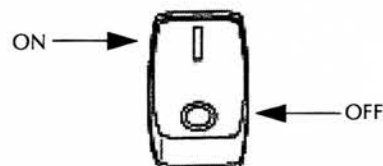


Figure 5 ON/OFF Power Switch

2. Switch the pump ON.
3. The isolation valve will open automatically 10 seconds after starting the pump.

Shutdown Procedure

To shutdown the pump:

1. Switch the pump OFF.

The isolation valve will close very quickly to isolate the vacuum chamber from the pump.

SH-112 Dry Scroll Vacuum Pump

Troubleshooting

Use the Troubleshooting chart in Table 5 to assist in defining a problem, determining a possible cause, and defining action steps to remedy the situation.

Table 5 Troubleshooting Chart

Problem	Possible Causes	Corrective Actions
Will not start	One or both fuses blown	Replace fuses. Identify cause of overload. Check the line voltage and the voltage configuration of the pump.
	Motor thermal protector open	Allow motor to cool. Identify cause of overload.
	Excessive voltage drop	Check size and length of cable.
	Defective motor	Inspect. Contact Agilent.
Poor ultimate pressure	System leak	Locate and repair leak.
	Water in pump	Flush pump with air or dry nitrogen.
	Gas ballast plugged	Replace breather vent. Contact Agilent.
	Solvent in pump	Flush pump with air or dry nitrogen. Install trap or filter.
	Tip seal worn out	Replace tip seal.
	Poor conductance to pump	Replumb with shorter and/or larger diameter tubing.
Hammering noise	Pump overheated	Check ventilation to pump. Check ambient temperature.
	Debris in pump	Check intake screen. Flush pump. Disassemble pump and inspect.
Pump runs intermittently	Motor thermal protector is cycling open and closed.*	Allow the motor to cool. Identify the cause of the overload.

* *The SH-112 is equipped with an auto-reset thermal motor protector. This protector will automatically shut down the pump when it detects an overload condition, and will automatically restart the pump when the motor has cooled to within an acceptable temperature range.*

Maintenance

Kits and Service Options

Agilent pumps will provide many years of trouble-free service if the maintenance procedures and intervals are observed. Cleaning and tip seal replacement are recommended when pump base pressure has risen to an unacceptably high level for your application. If your pump exhibits humming or grinding noises from the bearings, a major overhaul should be done by Agilent or an authorized rebuild center. Advance exchange pumps are available to minimize downtime.

The parts needed for tip seal replacement on the SH-112 are available in the kit described in Table 6. This kit contains seals and O-rings, and can be obtained from your Agilent dealer.

Table 6 Tip Seal Replacement Kit

Part Number	Description	Contents
SH0112TS	Replacement Tip Seal Set	Replacement Tip Seals and O-rings for SH-112 pumps

Factory Service

NOTE



SH-112 solid tip seals are not interchangeable with the SH-110 foam backed tip seal. SH-112 tip seal P/N# SH0112TS, SH0110TS will work on this pump.

Agilent offers rebuilding service at our factory, or you can obtain advance exchange of complete SH-112 pumps. The service plans available and their ordering numbers are given in Table 7.

Table 7 Factory Service Options

Factory Service Plans	Model Number
Advance Exchange SH-112 Pump	EXSH01121UNIV
Service/Rebuild SH-112	RPSH01121UNIV

Cleaning

Exterior

The exterior surfaces of the SH-112 may be cleaned with alcohol or mild detergents only.

Interior

Run the pump periodically at atmosphere for a minute or two to flush it out. For more information, see "Cleaning the Pump" on page 21.

Tip Seal Replacement

The parts and tools required to replace tip seals are listed below:

- Tip Seal Replacement Kit P/N SH0112TS
- 4 and 8 mm Allen wrenches
- 14 mm crescent wrench
- Razor blade or side-cutting pliers
- Compressed air (optional)

WARNING



If dangerous gases were being pumped, flush the pump with air or inert gas for at least 10 minutes prior to disassembly.

Figure 6 on page 24 shows the various components involved in a tip seal replacement procedure. Refer to Figure 6 as you follow the procedure.

To remove the worn tip seals:

1. Disconnect the pump from electrical power.
2. Remove (3) M8 socket head bolts (item 1).
3. Using a crescent wrench, remove the exhaust adapter (item 2).
4. Remove the front cowling and hang out of the way (item 3). Do not unplug.
5. If a solid 1/8" NPT plug is installed in the gas ballast port (item 6 in Figure 3 on page 17), remove it to vent the pump internally.
6. Remove (4) M5 bolts (item 4).
7. Remove the scroll housing axially off the frame (item 5).
8. Remove and discard the worn tip seals (item 6) and the main O-ring (item 7).
9. If compressed air is available, blow any remaining seal debris off the scroll parts. If seal debris is attached to the sides, use a razor or Exacto knife to scrape the debris off.

To install the new seals and O-rings:

1. Unpack the Tip Seal.
2. Install one end of the Tip Seal into the center end of the groove on the Orbiting Scroll (item 9).
3. Sequentially insert the seal from center to the outer edge of the scroll wall.

SH-112 Dry Scroll Vacuum Pump

- Cut the Tip Seal about 1/8" (3 mm) from the outer groove end.
- Use the remaining Tip Seal material to fill the seal groove on the Scroll Housing and again trim the excess Tip Seal so that a gap of about 1/8" (3 mm) remains at the outer end.
- Place the new main O-ring onto the Frame (item 10). Make sure the area where the O-ring sits is clean.
- Carefully replace the Scroll Housing making sure to line up the Locating Pins. Be sure that the Tip Seal has not fallen out of its groove.
- Reinstall (4) M5 bolts (item 4). Torque the (4) M5 bolts to 4 N-m (40 in-lbs).
- If a 1/8" NPT solid plug was removed from the gas ballast port during disassembly, reinstall it. Apply Loctite pipe thread sealant PTS 567 sparingly to the threads to ensure a gas tight seal.
- Place the front cowling in place and replace the M8 bolts.
- Reinstall the exhaust adapter. Apply Loctite pipe thread sealant PTS 567 sparingly to the threads to ensure a gas tight seal.
- Reconnect the pump to the electrical power mains.

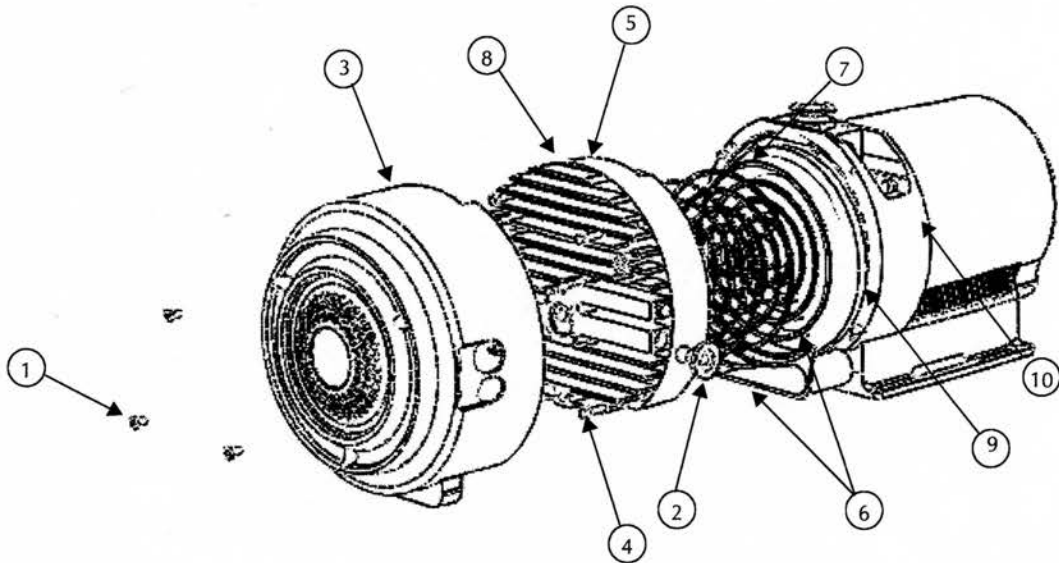


Figure 6 Exploded View of Pump Body

- | | |
|---------------------------------|---------------------------|
| 1. Front Cowling Bolts; M8 (3) | 2. Exhaust Adapter (NW16) |
| 3. Front Cowling | 4. Frame Bolts; M5 (4) |
| 5. Scroll Housing | 6. Tip Seals |
| 7. Main O-ring Parker No. 2-168 | 8. Locating Pins (2) |
| 9. Orbiting Scroll | 10. Frame |

To test the pump:

- Run the pump for about 5 seconds. Verify that the front fan is running.
If you hear loud noises or observe labored operation, this indicates that the Tip Seal or main O-ring are possibly out of place.
- Disassemble and repair as necessary.
The pump is now ready to return to service.

NOTE



Newly installed Tip Seals may require several hours of run time to seat properly and enable the pump to meet speed and base pressure specifications.

For the first one to two days after a tip seal replacement, periodically run the pump with an open inlet to help remove debris caused by the seating process. Typically, two to three times a day for two minutes each.